Information Management for Automated Demand Response in Large Facilities

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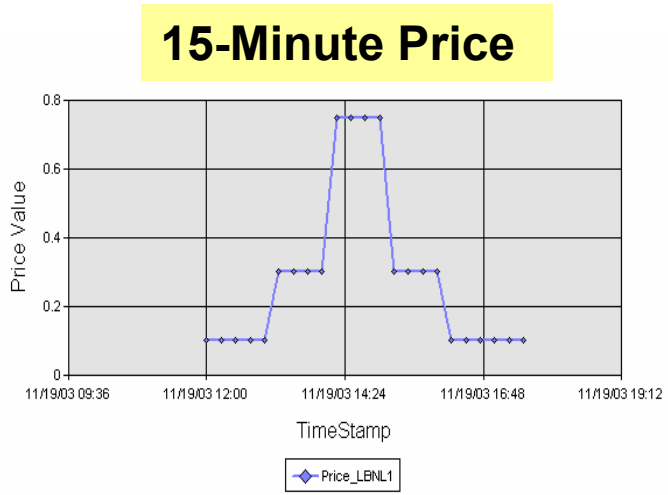
drrc.lbl.gov/autodr2

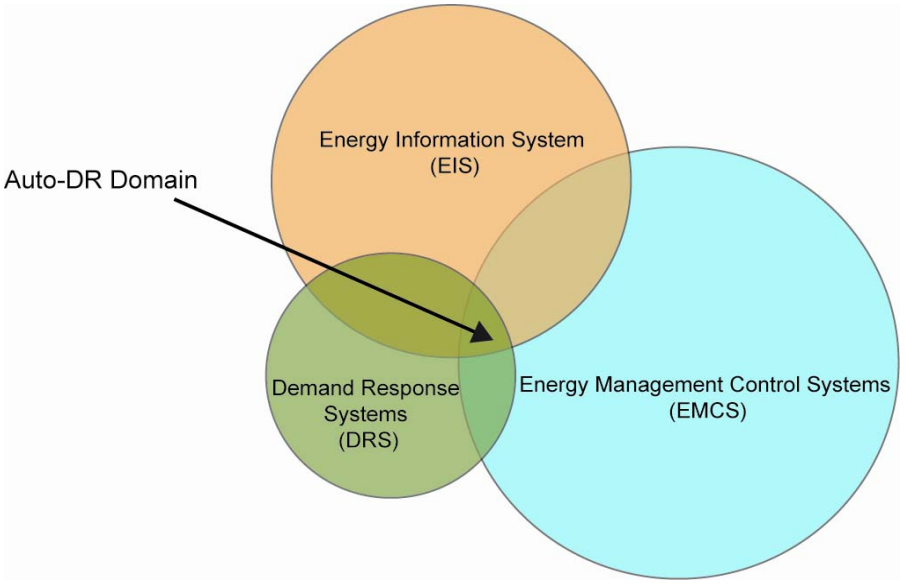
Project Overview

Goal: Evaluate feasibility of Automated DR hardware & software systems in large facilities

- Can control & communications systems receive signals & execute automated shedding?
- Control strategies for max load sheds & min service loss?

R&D Team: LBNL, Infotility, Shockman Consulting





2003 Automated-DR Sites

Albertsons – East 9th St. Oakland

Engagenet

Bank of America – Concord Technology Center

Webgen

General Services Admin - Oakland Fed. Building

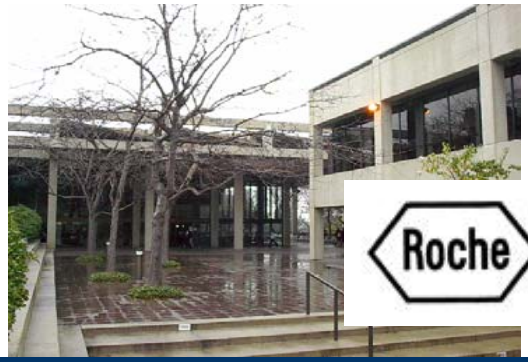
BACnet Reader

Roche Palo Alto – Office and Cafeteria

Tridium

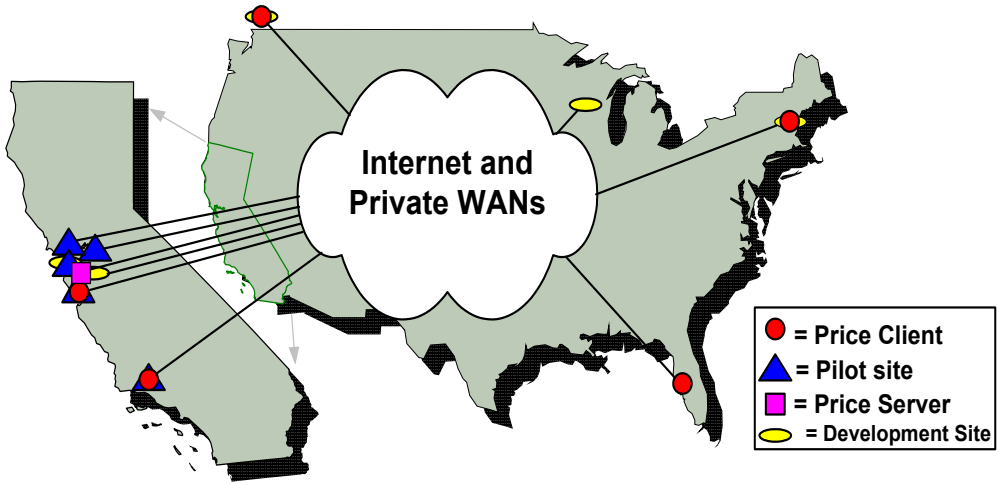
Univ. of Calif. Santa Barbara – Library

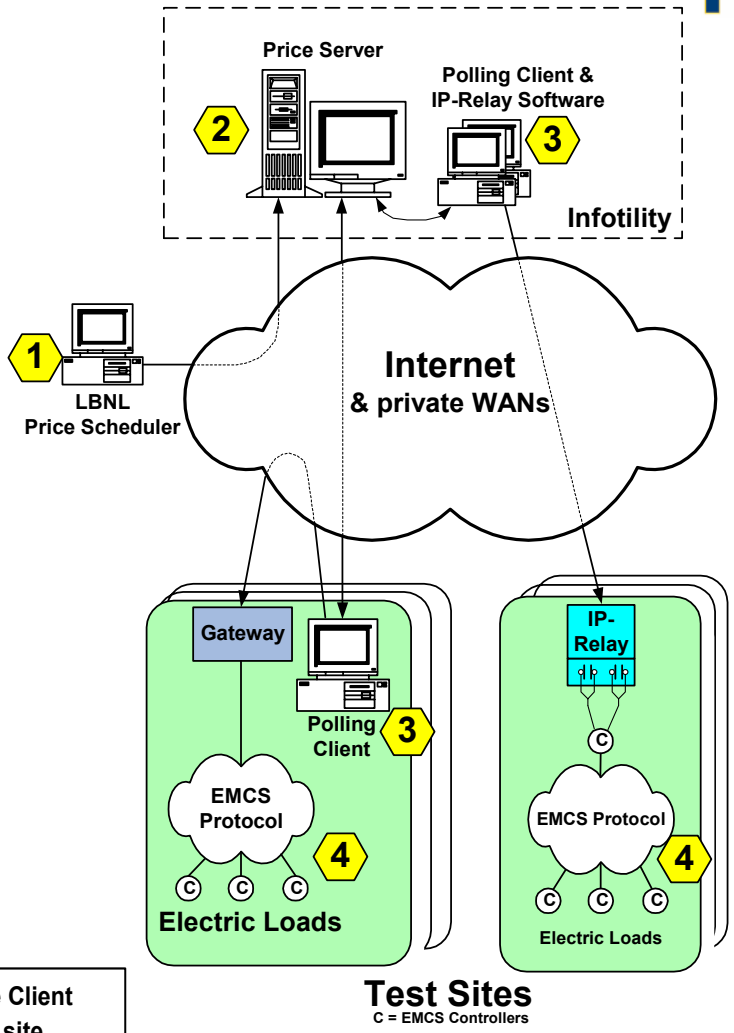
Itron Silicon Energy



Auto-DR System Communications

1. LBNL defines price schedule
2. Price published on XML server
3. Clients request price from server every minute & send shed commands
4. EMCS carries out shed





Methods: 2003 and 2004 Tests

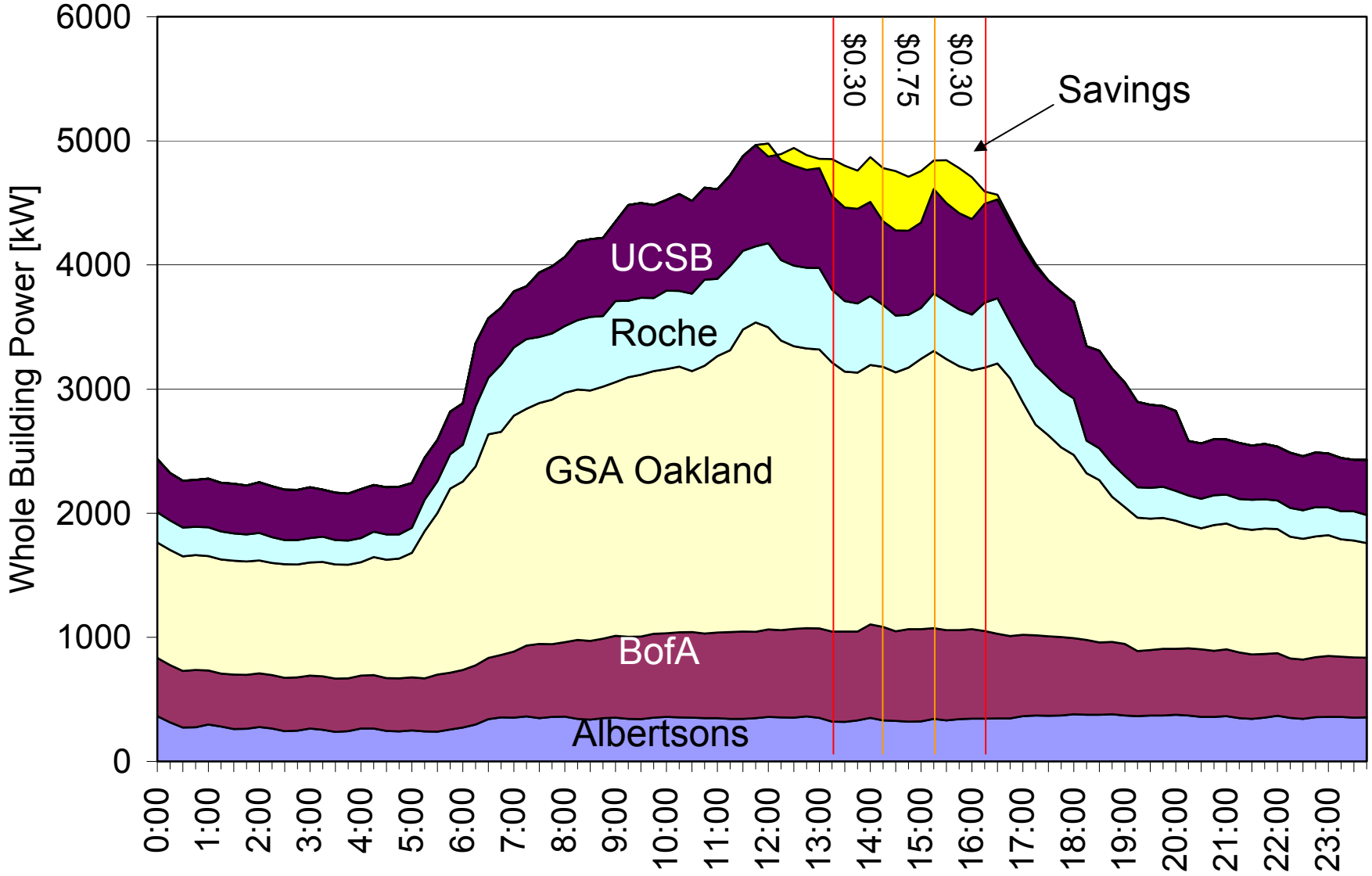
Field Tests

- Recruit, define strategies & measurement (detailed electricity, temperature, and trend-log analysis)
- 2003: 5 buildings, 1.5 million ft2
- 2004: 18 sites, 40 buildings, 10 million ft2

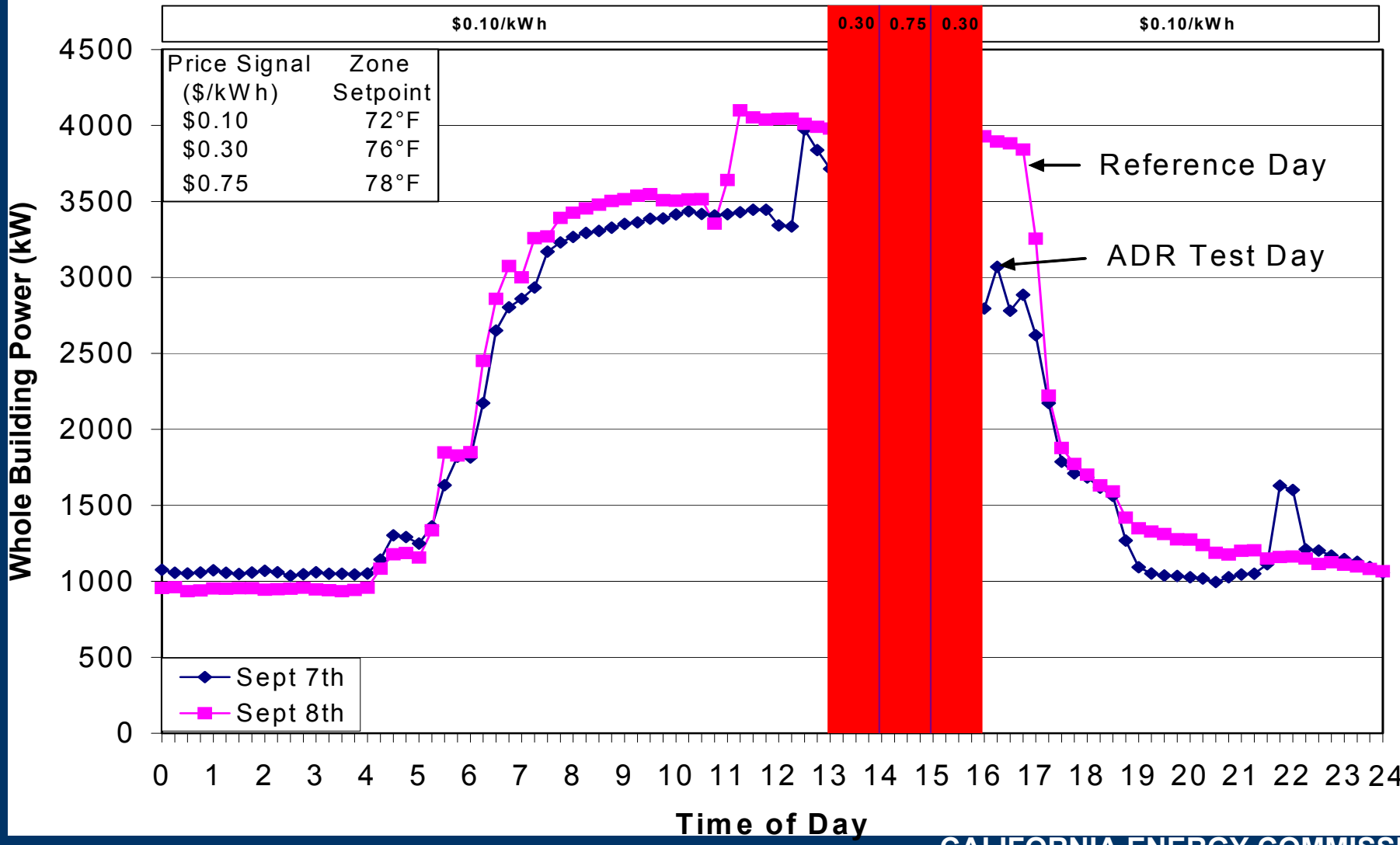
Connectivity

- Internet Gateway - Internet to EMCS
- Internet Protocol Relay (IP Relay) – Internet controlled relay (2004 only)

Results: 2nd Test November 2003



Results: Retest Sept. 2004 Oakland Federal (90ºF)



DR Shed Strategies

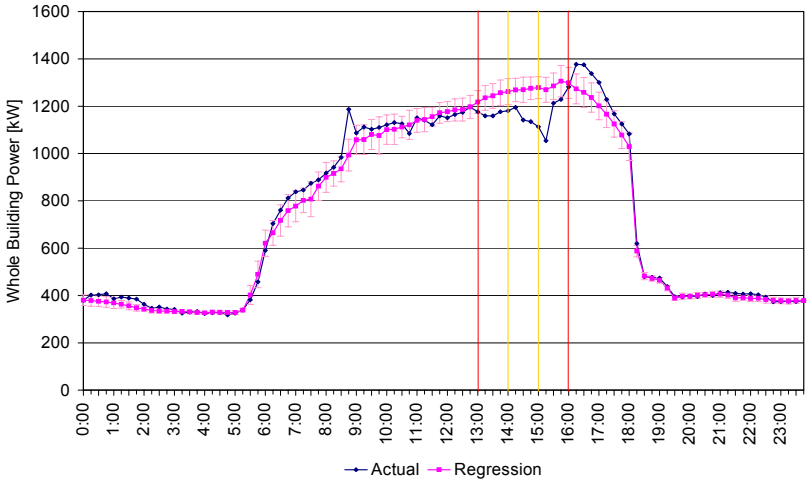
	HVAC											Lighting, misc.				
	Zone temperature increase	Supply air temp reset	Fan VFD limit	Fan off	Duct static pressure reset	Cooling valve close	Cooling fan-coil off	Direct chiller limit	Chilled water temp reset	Boiler pump (reheat) off	Electric humidifier off	Common area lighting	Office lighting shed	Anti-sweat heater shed	Fountain pump off	Transfer pump off
Albertsons												✓		✓		
B of A		✓	✓		✓											
GSA Oakland	✓															
Roche				✓												
UCSB Library			✓		✓	✓										
450 GG	✓															
NARA	✓															
Echelon	✓											✓	✓			
Monterey												✓				
300 CapMall	✓		✓	✓					✓						✓	
50 Douglas	✓															
Summit Ctr	✓															
Cal EPA					✓							✓	✓			
Kadent																✓
USPS SJ								✓								
CISCO	✓						✓			✓		✓	✓			
CETC				✓							✓					
OSI Soft	✓															

Results: 1st 2004 Scaled Up Test

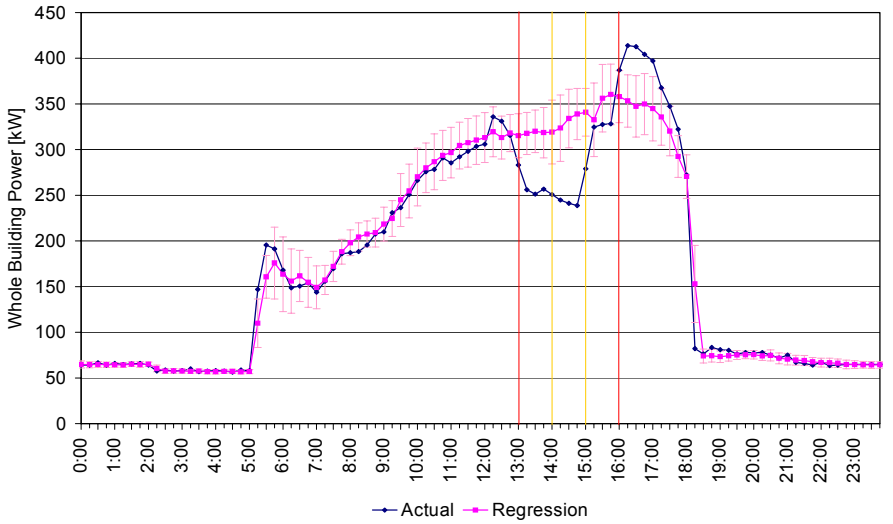
	IP Relay	Succeeded	Server Problem	Other Problem	Not Ready
Albertsons		x			
B of A	x	x			
GSA Oakland			x		
Roche		x			
UCSB				Gateway down	
450 GG			x		
NARA			x		
Echelon		x			
Monterey		x			
OSIsoft					x
300 Capitol	x	x		Maintenance	
50 Douglas	x	x			
Summit Ctr	x	x			
Cal EPA	x				x
Kadant				Maintenance	
USPS		x			
CISCO		x		EMCS	
CETC					x
Total	5	10	3	4	3

Results: 2004 Office Buildings

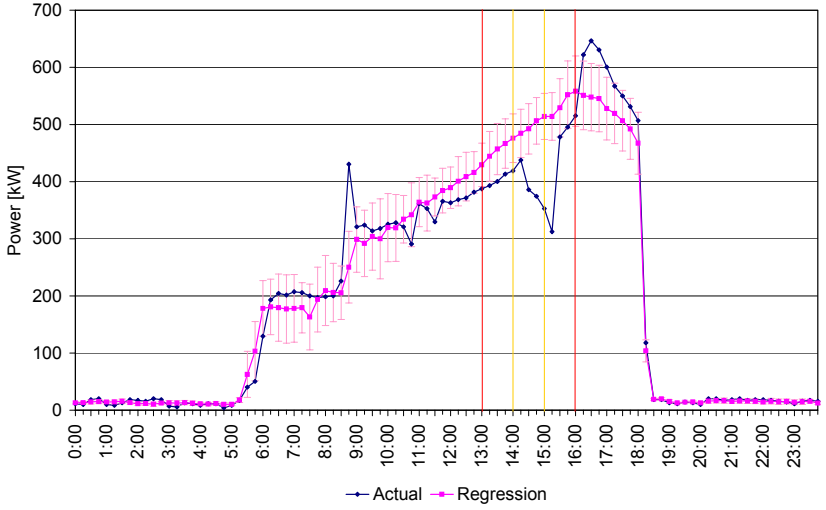
300 Capitol Mall: Whole Building Power and Baseline



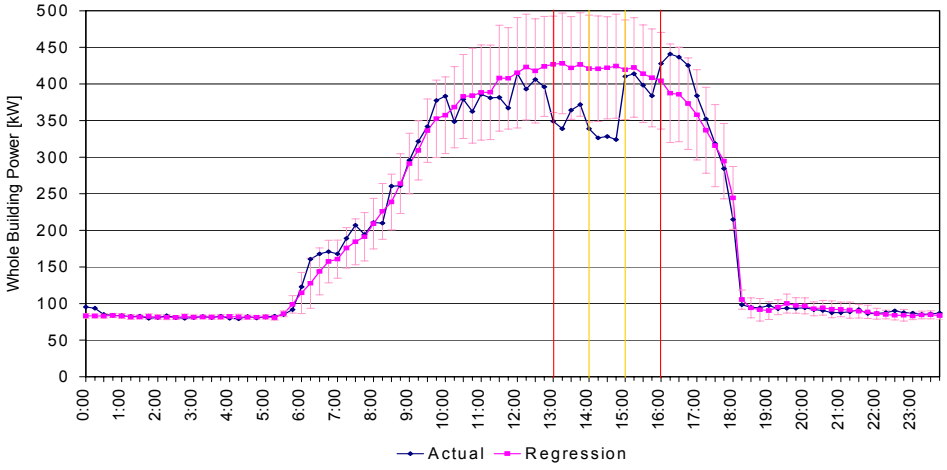
50 Douglas: Whole Building Power and Baseline



300 Capitol Mall: Mechanical Power and Baseline



Summit Center: Whole Building Power and Baseline



Summary and Next Steps

- **Automated DR is technically feasible**
- **New knowledge needed to develop, operate & evaluate technology & strategies for DR**
  - Rebound/recovery strategies needed
  - Link to daily efficiency clear to operators
- **Future R&D**
  - Guides to DR shed strategies
  - Scalable automation, security, latency, XML standards
  - Pilot tests with utilities, peer to peer forums
  - Economic evaluation tools/real-time simulation/ scenario analysis